Remarks

The foregoing proposed amendment presents amended claim 18. Claim 1, 12 and 14 were previously amended and the remaining claims 2-11, 13, and 15-20 are the original claims. As a result of this Amendment, claims 1-20 remain in the application. Allowance of claims 1-20 is respectfully requested.

Claims 1, 14, and 18 are objected to because the examiner believes the "output voltage is some how constrained by input voltage." This is a point of novelty with respect to most embodiments of the present invention. The Applicant claims that the "output voltage is unconstrained by an input voltage from the input voltage source" because embodiments of the invention are embodied by a four-quadrant output from a single switching converter that has no theoretical limit on its output voltage. This is in contrast to the cited art as will be further discussed below. Furthermore, as explained with regard to equation number 5 in the Applicant's specification: (5) Vout = Vin x [(Ts2 –Ts1)/Ts3]..."...as the absolute value of the time ratio in the brackets of equation (5) approaches infinity, the absolute value of the output voltage Vout also approaches infinity for any nonzero value of Vin, thus, the output voltage is not limited by the input voltage Vin."

The Examiner rejected claims 18-20 under 35 U.S.C. Section 102(b) as being anticipated by U.S. Patent No. 6,429,629 to Tranh To Nguyen ("Nguyen"). The examiner gives a broad interpretation to such cited art with respect to claim 18 since the claim states that it "operates in any one of four voltage current quadrants." As previously explained in the Applicant's prior response, Nguyen only operates in one voltage-current quadrant. To remove such broad interpretation, the Applicant has amended the claim language to state that applicant's device operates "in four voltage-current quadrants" instead of stating any one of four voltage current quantrants.

Nguyen discusses converters that have a center-tapped wound magnetic element or transformer with a DC input applied to the center tap and switches from each winding end to ground. The converters in Nguyen only operate in one voltage-current quadrant (positive voltage, positive current or negative voltage, negative current) as opposed to all four quadrants as now clearly recited in the claimed invention in independent claims 1, 14, and 18. The output voltage magnitude in Nguyen is also constrained by the input voltage. Nguyen states that the converters

shown in FIGs. 3A-3J are capable of output of "any polarity and magnitude." However, it must be understood that all of the converters in Nguyen operate inherently in one quadrant depending on the direction of the diodes or synchronous rectifiers and that the output magnitude is constrained by the input voltage and turns ratio of the transformer as stated on column 3, lines 47 through 52 of Nguyen. Thus, since the claims specifically recite operation in all four voltage current quadrants and further recite an output voltage unconstrained by the input voltage, the present invention is novel and certainly not obvious in view of the cited art. Further, it would also seem to be improper use of hindsight to attempt to use Nguyen as a reference to try to obviate the recited claims, particularly in view of the novel and nonobvious differences discussed above and in Applicant's background section. Again, the claimed invention overcomes the limitation of a constrained output voltage. Thus, for all the reasons provided above, Applicant respectfully submits that claims 18-20 are novel and non-obvious and overcome the rejection based Nguyen under 35 U.S.C. Section 102(b).

The Examiner also rejected claims 1-20 under 35 U.S.C. Section 102(b) as being anticipated by U.S. Patent No. 4,283,667 to Dinger ("Dinger"). Although Dinger does discuss being able to operate in all four voltage-current quadrants, the Applicant fails to see how the output voltage in Dinger is unconstrained by an input voltage from the input voltage source as recited in independent claim 1. Dinger's output (load) voltage is clearly constrained by the input voltage. It must be less than or equal to the peak voltage between L2 and L3, or, in the case of Dinger's Fig 10, the peak voltage between transformer center tap 378 and either terminal 380 or terminal 384, this peak voltage being related to the input voltage across L2 and L3 by the fixed transformer ratio. Further, as recited in claim 1, the Applicant fails to see how Dinger includes a switching arrangement that enables an output terminal to be in common with an input terminal. Additionally, Applicant could not find a mention of a "capacitor filter (C1)" nor a "third switch (Q1)" in Dinger.

The "Summing Amp and Phase Shift Circuit (27)" does not appear equivalent to a Pulse Width Modulator as presently claimed. Although the circuit does create pulse signals "A" and "B" that control switches, Dinger's description further explains that their circuit operates by changing the phase of these signals relative to a reference signal "F" and that an additional and separate circuit, that of Dinger's Fig. 6, creates an additional switch-control signal, "C" to serve as a "lockout" signal. This signal does not appear equivalent to any of the switch control signals

or pulse with modulator as recited in the present invention as it is unrelated in time to the other signals "A" and "B". Furthermore, these signals lack the time relationship described in the application and recited in various dependent claims.

Dinger appears to fail to teach or suggest, mention or contemplate quite a few elements in the dependent claims. For example, as recited in claim 3, there is no teaching that the windings of the single inductor are tightly coupled magnetically. The Applicant fails to see bi-directional switches that are controlled by a pulse width modulator as recited in claims 4 and 15. Although Dinger illustrates a "Summing Amp and Phase Shift Circuit"27, this does not appear to be equivalent to a pulse width modulator. (See FIG. 7 and corresponding description starting on col. 11, line 41 in Dinger). With respect to claim 6, Dinger appears to fail to include a capacitor between an output terminal and a negative terminal of an input voltage source, particularly a capacitor that filters a pulsating output current that flows when a third switch is turned on. Where is this taught in Dinger?

Dinger certainly fails to illustrate, suggestion or contemplate a pulse width modulator that controls switches such that a third switch is on when neither the a first switch no a second switch is on and such that the first switch and the second switch cannot be on at the same time as recited in claim 7. Where does Dinger show a plurality of switches that operate in a cyclical sequence and at a constant frequency as recited in claim 8 or a third switch that has an on-time that is constant and less than a period of the cyclical sequence as recited in claim 9? Where does Dinger show the closure of the first switch causes current flow into a reference phase inductor terminal to increase while the second switch causes current flow into a second reference phase inductor terminal to decrease such that a greater on-time among the first switch and the second switch determines the polarity of the output voltage as recited in claim 10? Inasmuch as Dinger is a motor field exciter for driving a field winding of a DC motor, the particular circuitry and purposes in Dinger are clearly different from the claimed invention herein.

Applicant thus believes that until the Examiner clearly shows how each element of the claims is clearly anticipated by the cited references, a rejection based on Dinger under 35 U.S.C. Section 102(b) is misplaced. Applicant also respectfully submits that claims 1-20 are novel and non-obvious and overcome the rejection based Dinger under 35 U.S.C. Section 102(b).

Finally, the Applicant believes that the Final Rejection in this instance may have been premature. An examiner may properly issue a final rejection when the applicant amends the

claims in response to a prior art rejection in the first action if that amendment requires the examiner to perform a new search and the examiner finds references necessitating a new ground for the rejection of the amended claims. But was the new rejection truly "necessitated by" the applicant's amendment when the subject matter was clearly already found in the original claims? In this instance, claim 18 remained un-amended after the first amendment and included language that the output current operated in any of four voltage-current quadrants. Furthermore, the claims that were amended (claims 1 and 14) in the first amendment merely incorporated elements (operation in 4 quadrants) that were already in the preamble of claims 1 and 14 into the body of the claims and involves substantially the same subject matter already found in original claim 18. Thus, this scenario would not appear to present a situation where the amendment necessitated a new search as a result of the amendments by the Applicant. The MPEP generally provides that a Final office action is improper where an originally presented claim is rejected on a new art reference that was not cited in an information disclosure statement by the applicant.

Of course, rather than further prosecution, an indication of allowability is respectfully requested instead. Should any minor points remain prior to issuance of a Notice of Allowance, the Examiner is requested to telephone the undersigned at the below listed telephone number.

Respectfully submitted,

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